



# PATENT SPECIFICATION

Application Date: Dec. 15, 1932. No. 20,484 / 33.

405,200

(Divided out of No. 405,095.)

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Complete Accepted: Feb. 1, 1934.

## PROVISIONAL SPECIFICATION.

### Change-speed Mechanism, Chiefly for Motor-Vehicles.

We, ALVIS CAR & ENGINEERING COMPANY LIMITED, a British Company, GEORGE THOMAS SMITH-CLARKE and WILLIAM MARSHALL DUNN, both British Subjects, all of Alvis Works, Holyhead Road, Coventry, Warwickshire, do hereby declare the nature of this invention to be as follows:—

This invention relates to change-speed gearing, chiefly for use on motor-vehicles, and has for its main object to provide an improved construction with which three or four forward speeds can be introduced on so-called synchro-mesh principles.

In one application of the invention, the gear-box is in the form of a trough, the lay shaft and a sliding reverse wheel being carried in the lower part while the top of the trough lies upon the axis of the concentric driving and driven shafts. The cover is secured to the trough portion by long studs or bolts and it may also carry the sliding selector bars and a shaped up-standing part supporting the change-speed lever. Both parts of the box are formed near the centre of the length of the gearbox with webs which co-operate to support bearings for both the driven shaft and the lay shaft near their mid lengths. These webs practically divide the box into a forward and a rear compartment, and in the forward compartment is arranged the gearing providing a direct drive and the next highest, or third, speed. This is of the constant-mesh and some well-known synchro-mesh type.

In the rear compartment there are two sets of gear-pairs, one for the first and the other for the second speed, respectively, and these are adapted for clutch operation. That is to say, one gear-wheel is fixed to its shaft and the other free thereon, a clutch locking it to its shaft when required, which may be effected in various well-known ways.

In one arrangement, the fixed pinion of

the first speed gear-pair is on the lay shaft, and the clutchable free gear-wheel on the driven shaft. Between the bore of this free gear-wheel and the driven shaft is interposed a sleeve which is fixed to the driven shaft and externally forms a bearing surface on which the free gear-wheel can rotate. This sleeve is integral with or attached to a special gear-wheel used solely for reverse drive, which is consequently fixed to the driven shaft. This can be quite a narrow gear-wheel so as to add little to the length of the gear-box, and it may be located between a washer lying against the adjacent driven shaft gear-wheel and a split abutment ring which lies in a circumferential groove in the splines on the driven shaft. These splines are used for fixing the special gear-wheel to its shaft and for the sliding clutch member employed for clutching the free gear-wheel to the driven shaft.

The sliding reverse gear-wheel is located, when out of use, between the gear-pairs for first and second speed and is adapted, when required, to be meshed with the fixed pinion on the lay shaft and with the special gear-wheel, causing the driven shaft to be rotated in the opposite direction to the driving shaft.

By this invention all the gears can be engaged by means of clutches with synchro-mesh devices. Usually, with other gear-boxes, the first gear-ratio at least is brought into operation by sliding the gear-wheels into mesh with one another, and consequently synchro-mesh mechanism cannot be employed on the first speed, rendering changing down from second speed to first speed a difficult operation.

Dated this 19th day of July, 1932.  
WALFORD & HARDMAN BROWN,  
Chartered Patent Agents,  
18 & 19, Hertford Street, Coventry,  
Warwickshire.

## COMPLETE SPECIFICATION.

### Change-speed Mechanism, Chiefly for Motor-Vehicles.

We, ALVIS CAR & ENGINEERING COMPANY LIMITED, a British Company, GEORGE THOMAS SMITH-CLARKE and WILLIAM MARSHALL DUNN, both British Subjects, 90  
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all of Alvis Works, Holyhead Road, Coventry, Warwickshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to change-speed gearing, chiefly for use on motor-vehicles, and has for its main object to provide an improved construction with which three or four forward speeds can be introduced on so-called "synchro-mesh" principles, that is, by means of auxiliary friction 10 clutches for synchronizing dog clutches or other elements to be meshed for the introduction of a selected speed. One form of such gear-box is shown in Figure 1 of the drawings of patent specification No. 20 352,858.

According to the invention, the casing of a change-speed gearing, providing at least three forward speeds all introduced on "synchro-mesh" principles, is split 25 about the axis of the driven shaft into upper and lower parts, the lay-shaft being carried in the latter.

Preferably the casing is also partitioned, in a manner known per se, by internal 30 webs into front and rear compartments, and the forward compartment may contain the mechanism for the direct drive and the next speed and the rear compartment that for one or more lower speeds, 35 and also that for the reverse drive. The webs can be adapted to carry intermediate bearings for the shafts which is very important in view of their length.

In a preferred arrangement there are 40 three indirect forward drives all through constantly meshing gear-pairs of which all the gears on the lay-shaft are fast thereon. The lay-shaft can be inserted into the lower part of the casing through one 45 end thereof and threaded through the gears and bearings. The means for selectively clutching the free gears to the driven shaft can be assembled on the latter before it is placed in position between the 50 upper and lower parts of the casing.

In the accompanying drawings:—

Figure 1 is a longitudinal section through one form of gear-box according to the invention;

55 Figure 2 is a cross-section, taken mainly on the line II—II of Figure 1, indicating the arrangement of the reverse drive; and

60 Figure 3 is a cross-section through one of the clutching devices on the driven shelf, this construction being known per se.

In the construction illustrated, the 65 lower part of the gear-box casing is in the form of a trough 11, the lay-shaft 12

and a sliding reverse wheel 13 being carried low down in the trough while the top, 14 of the trough lies upon the axis of the concentric driving and driven shafts, 15, 16. Although the top of the trough is shown as being co-planar with this axis, it obviously need not be. It could, for example, be V-shaped in end elevation. The upper part or cover 17 of the gear-box casing is secured to the trough by long studs or bolts 18, and it may also carry the sliding selector bars 19 and a shaped upstanding part 20 supporting the change-speed lever 21.

Both parts of the box are formed near the centre with webs 22 which co-operate to support bearings 23 for both the driven shaft and the lay-shaft near their mid-lengths. These webs practically divide the box into a forward and a rear compartment, and in the forward compartment is arranged the gearing providing a direct drive and the next highest, or third, speed. This is of the constant-mesh and some well-known "synchro-mesh" type.

The drawings show a constant-mesh gear-pair 24 for driving the lay-shaft, and dogs 25, 26 for the direct drive. The latter dogs are carried by the clutch sleeve 27 splined on the driven shaft. The clutch sleeve is associated with the striking fork and the outer sleeve 28 carrying the friction surface 29 in a known manner such that movement of the striking fork in the appropriate direction first brings 100 the surface 29 into frictional contact with the co-acting surface 30 associated with the driving dogs 25, and the dogs 25, 26 cannot be engaged until the friction surfaces 29, 30 have been synchronized. 105

Third speed is through the constantly-meshing gears 31, 32, the latter being locked to the driven shaft by the engagement of the dogs 33 after the friction surfaces 34 have been engaged and synchronized, as above described, by movement of the striking fork in the opposite direction.

In the rear compartment there are two sets of gear-pairs, one, 35, 36, for the first 115 and the other 37, 38, for the second speed, and these are also adapted for clutch operation. The gear-wheels on the lay-shaft are fixed thereto and the others, 36, 38, are free on the driven shaft. A clutch, 120 comprising an inner sleeve 39 with dogs 40, 41 and an outer sleeve 42 with frictional surfaces 43, 44, is provided for locking the selected gear to its shaft when required, this double-acting clutch being 125 similar to that for top and third speed.

In the present arrangement, as described in our co-pending patent specification No. 35,544/32, (Serial No. 405,095), between the bore of the free gear-wheel 36 and the 130

driven shaft is interposed a sleeve 45 which is fixed to the driven shaft and externally forms a bearing surface on which this free gear-wheel can rotate. 5 This sleeve is integral with a reverse gear-wheel 46 which is consequently fixed to the driven shaft.

The sliding reverse gear-wheel 13 is located, when out of use, between the 10 gear-pairs for first and second speed and is adapted, when required, to be meshed with the fixed pinion 35 on the lay-shaft and with the gear-wheel 46, causing the driven shaft to be rotated in the opposite 15 direction to the driving shaft.

By this invention all the gears can be 20 engaged by means of clutches with "synchro-mesh" devices. Usually, with other such gear-boxes, intermediate hearings could not be provided for the driven 25 shaft and lay-shaft, owing to the impossibility of assembling the parts, or, if provided, the gear-box would have to be divided transversely—instead of longitudinally—an arrangement which has 30 certain disadvantages from a practical standpoint. With the arrangement here illustrated, however, the lay-shaft can be inserted through one end of the gear-box 35 and threaded through the lay-shaft gears and the bearings. All the bearings are 40 positively located on the lay-shaft, the intermediate one by the circlips 47 engaged in unsplined portions of the lay-shaft. The gear 35 is also positively 45 located between the circlip 48 and the spacer 49, but the other three lay-shaft gears are located by the engagement of their "herring-bone" teeth with the 50 teeth of the mating gears when the pre-assembled driving and driven shafts are lowered into position in the top of the trough prior to the assembly of the cover.

Having now particularly described and 55 ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Change-speed gearing with at least three forward speeds introduced on "synchro-mesh" principles and with the casing split about the axis of the driven shaft into upper and lower parts, the lay-shaft being carried in the lower part. 50

2. Change-speed gearing where the casing is partitioned by internal webs into a forward compartment containing the mechanism for the direct drive and next speed, these being introduced on "synchro-mesh" principles, and a rear compartment containing the mechanism for one or more lower speeds, also adapted to be introduced on synchro-mesh principles, the casing being split about the axis of the driven shaft into upper and lower parts of which the latter carries the lay-shaft. 55

3. Change-speed gearing where the casing is split about the axis of the driven shaft into upper and lower parts, the latter carrying a lay-shaft which is in constant mesh with the driving shaft and has at least two gears fast thereon and in constant mesh with gears free on the driven shaft, and clutching means on the driven shaft, for the free gears, by which the speeds can be introduced on "synchro-mesh" principles. 60

4. A gearing, according to any preceding claim, adapted to provide four forward speeds all introduced on "synchro-mesh" principles, and having bearings for the driven and lay-shafts near the middle. 65

5. A gearing, according to any preceding claim, where the lay-shaft is inserted into the lower casing part from one end and threaded through the gears and bearings. 70

6. The complete gear box, substantially as hereinbefore described or as shown in the accompanying drawings. 75

Dated this 9th day of August, 1933.  
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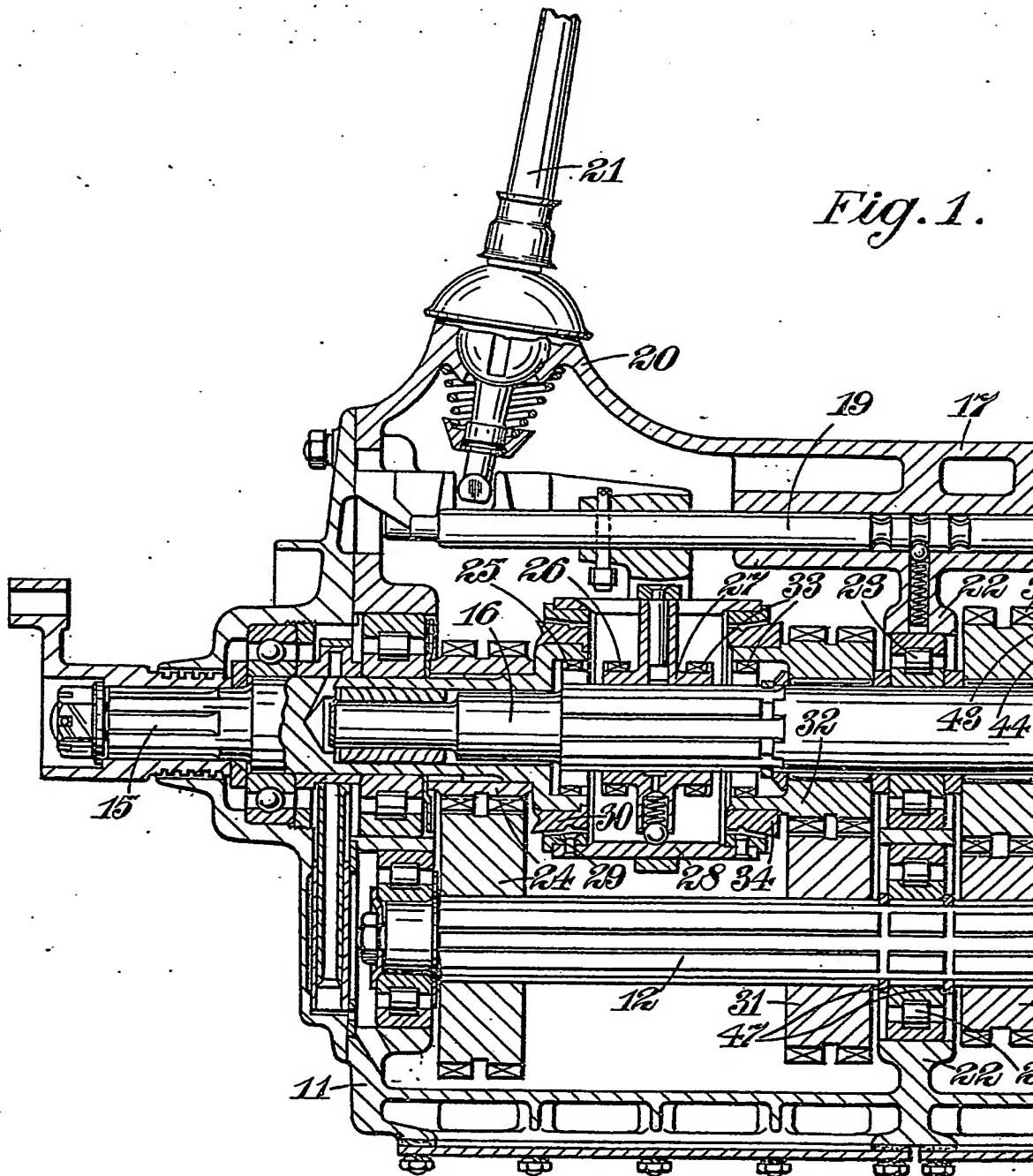
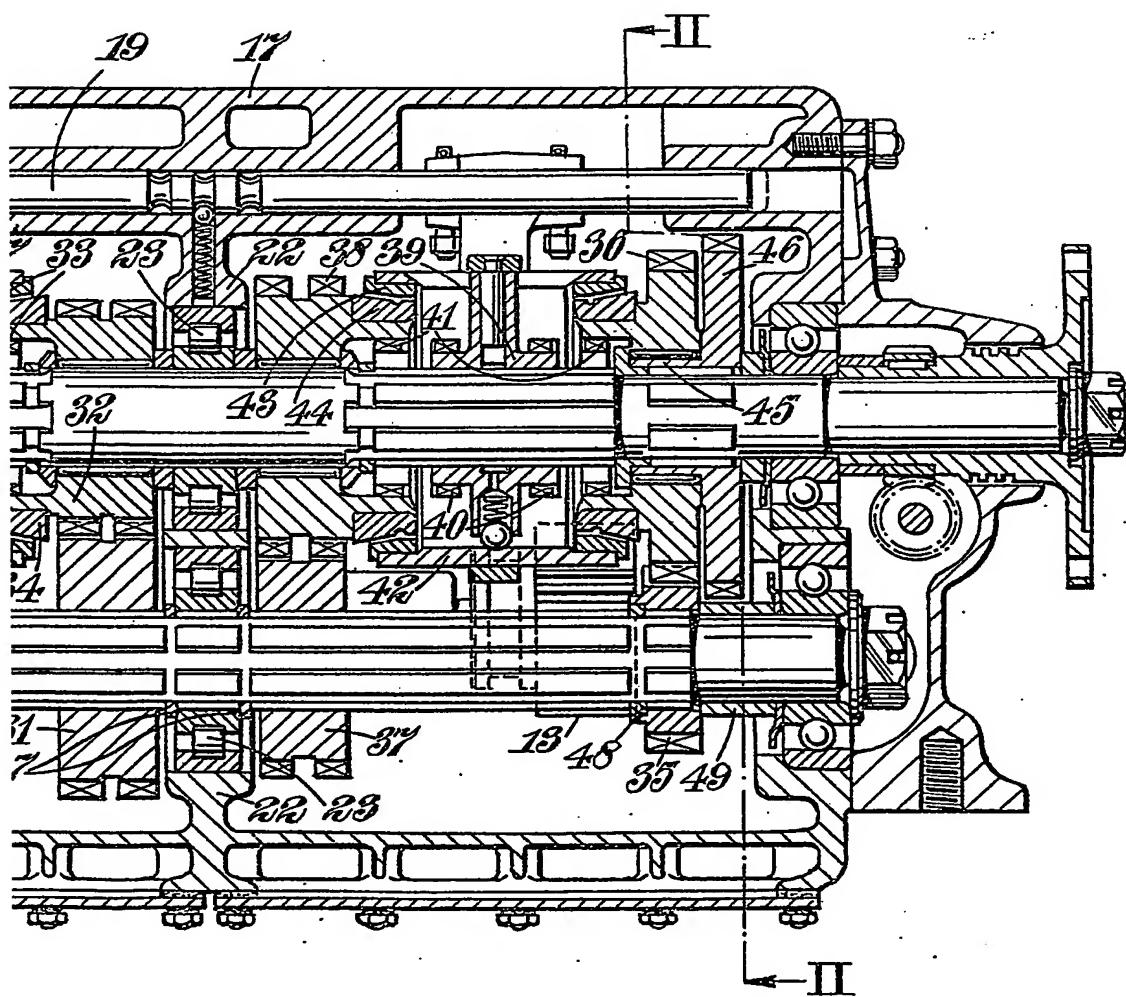
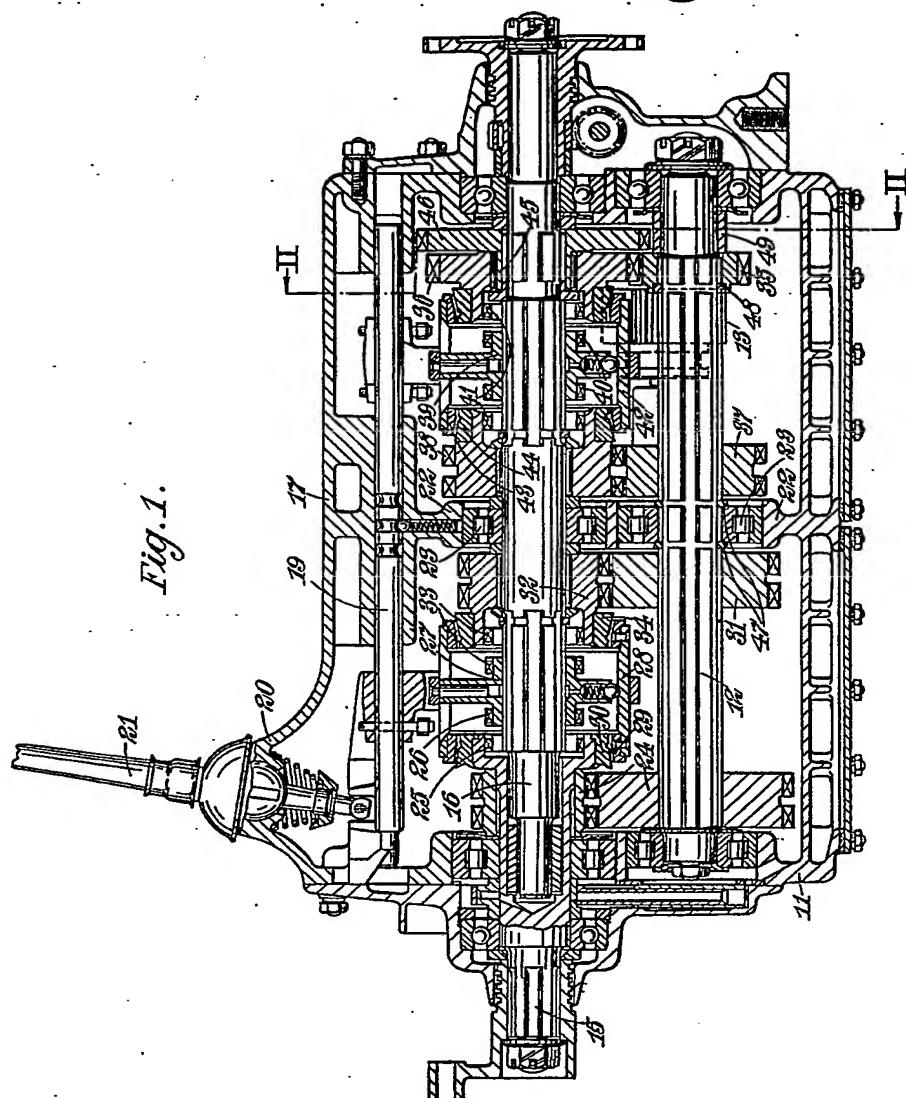


Fig. 1.

Fig. 1.



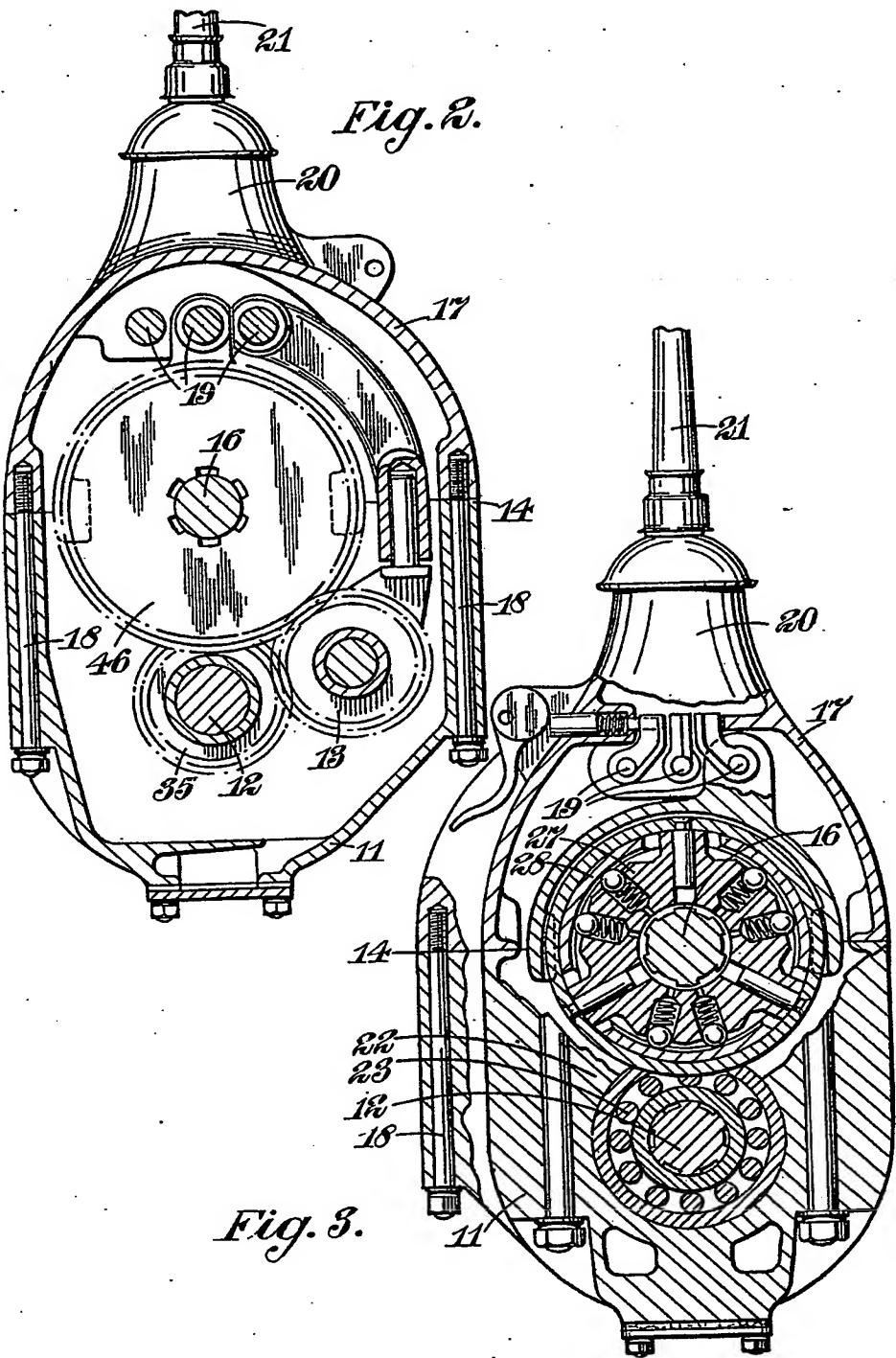
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